

## **Definitions of Sound Ecological Environment – Big Bend Reach of the Rio Grande**

SB3 did not define Sound Ecological Environment, the following is an interpretation from **SAC (2006)**

A sound ecological environment is one that:

- sustains the full complement of native species in perpetuity,
- sustains key habitat features required by these species,
- retains key features of the natural flow regime required by these species to complete their life cycles, and
- sustains key ecosystem processes and services, such as elemental cycling and the productivity of important plant and animal populations.

The Trinity San Jacinto BBEST added a criterion taken from the Texas Instream Flow Program Technical Overview Document:

- A resilient, functioning ecosystem characterized by intact, natural processes, and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of a region.

As noted by previous BBESTs these criteria are broad and it may hard to support determinations. What follows is a first run at each.

### **Sustains the full complement of native species in perpetuity**

Seven of the 36 native fish have been extirpated and eight species have been listed as species of concern (see attached). A recent mussel survey found only dead shells of three of five species that are believed to exist in the area. Dr. Forstner has reported that the lack of flows is contributing to the success of the invasive red eared slider and its hybridization and displacement of the Big Bend Slider. This is in contrast to the recent success of the reintroduction of the Rio Grande Silvery Minnow. It is reasonable to suggest that this success is attributable to concurrent timing between the initial release and the channel reset flows of late 2008. Monitoring of the RGSM through the next phase of channel sedimentation and narrowing will remain an important element of adaptive management programs. The overall trend is a decline in native species diversity.

The GSA BBEST, noted declines in fishes from several habitat guilds, increases in exotics and alterations to trophic structure, yet still found for a SEE based upon two studies that found fish populations relatively intact. “Relatively intact” and “full complement” are not equal.

I am not aware of published studies indicates the intactness of Rio Grande fish communities. I think Tim Bonner has been working on this but do not see any publication on his website.

With the information I currently have, I am inclined to say this criterion is not met.

### **Sustains key habitat features required by these species**

Dean (2011) has documented system wide (100+ miles) channel sedimentation, narrowing, and a loss of exposed gravel bars and multithreaded sections. The same has been documented for the El Paso to Presidio reach (Everitt). Dean further documented that reset events only partially recover channel features and that channel narrowing occurs rapidly; the overall trend is a alteration of channel and habitat features from a wide multithread channel with shallow and sparsely vegetated banks to a narrow, deeper channel with steeper heavily vegetated banks.

Given the long term trend this criterion is not met.

**Retains key features of the natural flow regime required by these species to complete their life cycles.**

Dr. Forstner at UT has suggested (personal communication) that the success of the Red Eared Slider over the Big Bend slider can be attributed to diminished current velocities.

The current flow regime may not initiate spawning for the RGSM. How big a rise is needed? What months will work?

No studies exist that might explain the decline of native mussels, but the exotic Asian clam (*Corbicula fluminea*) is very abundant. Given there much smaller size relative to the native species, I'll go out on a limb here and suggest that the ability of a mussel to feed is proportional to the amount of water it can filter which is a function of the velocity of the water. Therefore, smaller mussels have smaller (less mass) feeding requirements and can compete better at low flows.

I am not aware of enough scientific information to make a determination on this criterion.

**Sustains key ecosystem processes and services, such as elemental cycling and the productivity of important plant and animal populations.**

I am not aware of any work identifying key ecosystem processes. There is some work for the Middle Rio Grande in New Mexico, we could adapt that for use here and, to build adaptive management strategies and to direct future work.

Stephan Porter has begun looking at productivity using data from the two TCEQ/USGS gages. I don't think this info will be available in time.

Key processes like hyporheic exchange and nutrient spiraling need to be studied in the context of channel evolution.

I am not aware of enough scientific information to make a determination on this criterion.

**A resilient, functioning ecosystem characterized by intact, natural processes, and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of a region.**

jbennett

This criteria provides the most wiggle room and would allow us to pull away from the first set of criteria.

### **Water Quality Standards,**

Both 2306 (Big Bend Reach) and 2307 (El Paso to Rio Conchos) are listed as impaired, with violations of chloride, sulfate, and TDS common to both reaches.

Fish kills associated with rises in stage need to be investigated.

### **Indices of Biological Integrity**

Dr. Bill Harrison (TCEQ) was working on this as was WWF, neither are done to my knowledge.

### **Sediment Transport**

Studies just beginning, not likely to be enough information to make a determination on this criterion.

### **Literature**

Bean, M.G. and T.H. Bonner. 2010. Spatial and temporal distribution of *Bothriocephalus acheilognathi* (Cestoda: Bothriocephalidea) in the Rio Grande (Rio Bravo del Norte). Journal of Aquatic Animal Health 22:182-189.

Smith, A., M. Chumchal, T.H. Bonner, and W.H. Nowlin. 2010. Mercury contamination of the Rio Grande/Rio Bravo Del Norte fish community: spatial variation and influence of environmental gradients. Environmental Toxicology and Chemistry 29:1762-1772.

### **FISHES OF BIG BEND NATIONAL PARK AND THE RIO GRANDE WILD AND SCENIC RIVER**

Taxa, Common Name	Scientific Name	Origin	Status
Sturgeon ( <i>Acipenseridae</i> ) Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>	Native	TX-T, Extirpated
Gar ( <i>Lepisosteidae</i> ) <sup>i</sup> Alligator Gar Spotted Gar Longnose Gar	<i>Atractosteus spatula</i> <i>Lepisosteus oculatus</i> <i>Lepisosteus osseus</i>	Native Native Native	Maybe Extirpated
Eel ( <i>Anguillidae</i> ) American Eel	<i>Anguilla rostrata</i>	Native	Extirpated
Shad ( <i>Clupeidae</i> ) Gizzard Shad	<i>Dorosoma cepedianum</i>	Native	

Threadfin Shad	<i>Dorosoma petenense</i>	Possibly Introduced		
Minnows ( <i>Cyprinidae</i> )				
Mexican Stoneroller	<i>Campostoma ornatum</i>	Native	US-SOC, TX-T, AFS-SOC	
Red Shiner	<i>Cyprinella lutrensis</i>	Native		
ii Maravillas Red Shiner	<i>Cyprinella lutrensis blairi</i>	Native	EXTINCT	
Blacktail Shiner	<i>Cyprinella venusta</i>	Introduced		
Common Carp	<i>Cyprinus carpio</i>	Introduced		
iii Roundnose Minnow	<i>Dionda episcopa</i>	Native	Extirpated	
Silvery Minnow	<i>Hybognathus amarus</i>	Native	Extirpated, US-E, AFS-SOC	
Speckled Chub	<i>Macrhybopsis aestivalis</i>	Native		
Tamaulipas Shiner	<i>Notropis braytoni</i>	Native		
Chihuahua Shiner	<i>Notropis chihuahua</i>	Native	TX-T	
Rio Grande Shiner	<i>Notropis jemezianus</i>	Native	US-SOC, AFS-SOC	
iv Phantom Shiner	<i>Notropis orca</i>	Native	EXTINCT	
v Bluntnose Shiner	<i>Notropis simus simus</i>	Native	EXTINCT	
Fathead Minnow	<i>Pimephales promelas</i>	Native		
Bullhead Minnow	<i>Pimephales vigilax</i>	Native		
Longnose Dace	<i>Rhinichthys cataractae</i>	Native		
Suckers ( <i>Catostomidae</i> )				
River Carpsucker	<i>Carpionodes carpio</i>	Native		
Blue Sucker	<i>Cycleptus elongatus</i>	Native	US-SOC, TX-T, AFS-SOC	
Smallmouth Buffalo	<i>Ictiobus bubalus</i>	Native		
Black Buffalo	<i>Ictiobus niger</i>	Native		
West Mexican Redhorse	<i>Moxostoma austrinum</i>	Native	AFS-SOC	
Characins ( <i>Characidae</i> )				
Mexican Tetra	<i>Astyanax mexicanus</i>	Native		
Catfishes ( <i>Ictaluridae</i> )				
Blue Catfish	<i>Ictalurus furcatus</i>	Native		
vi Headwater Catfish	<i>Ictalurus lupus</i>	Native	US-SOC, AFS-SOC	
Channel Catfish	<i>Ictalurus punctatus</i>	Native		
Flathead Catfish	<i>Pylodictis olivaris</i>	Native		
vii Chihuahua catfish	<i>Ictalurus</i> sp.	Native	Rare	
Killifishes ( <i>Cyprinodontidae</i> )				
Plains Killifish	<i>Fundulus zebrinus</i>		Introduced	
viii Conchos pupfish	<i>Cyprinodon eximius</i>	Native	Extirpated, TX-T	
Livebearers ( <i>Poeciliidae</i> )				
Western Mosquitofish	<i>Gambusia affinis</i>	Native		
Big Bend Gambusia	<i>Gambusia gaigei</i>	Native	US-E, TX-E, AFS-E	
Silversides ( <i>Atherinidae</i> )				
Tidewater Silverside	<i>Menidia beryllina</i>	Introduced		

Temperate Basses (*Percichthyidae*)

White Bass	<i>Morone chrysops</i>	Introduced
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Sunfishes (*Centrarchidae*)

Green Sunfish	<i>Lepomis cyanellus</i>	Native
Warmouth	<i>Lepomis gulosus</i>	Native
Bluegill	<i>Lepomis macrochirus</i>	Native
Redear Sunfish	<i>Lepomis microlophus</i>	Introduced
Largemouth Bass	<i>Micropterus salmoides</i>	Native

Drums (*Sciaenidae*)

Freshwater Drum	<i>Aplodinotus grunniens</i>	Native
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Cichlids (*Cichlidae*)

Blue Tilapia	<i>Oreochromis aureus</i>	Introduced
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TX = State of Texas Listed

US = Federally Listed

AFS = American Fisheries Society

T = Threatened

E = Endangered

SOC = Special Concern (Species of Concern)

Sources:

1<sup>st</sup> list 1990 by Steve Platania, (University of New Mexico)

Revised 2003 by Raymond Skiles (Editor), Robert Edwards (University of Texas - Pan American), Clark Hubbs (University of Texas - Austin), and Gary Garrett (TPWD Heart of the Hills Research Center).

Endnotes:

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- <sup>i</sup> No alligator gar have been taken in recent years, yet some may still remain.
  - <sup>ii</sup> Maravillas red shiner (*Cyprinella lutrensis blairae*), from upper Maravillas Creek, Brewster County, is thought to have gone extinct in about 1960.
  - <sup>iii</sup> Roundnose minnow (*Dionda episcopa*) was once found in Tornillo Creek by Carl Hubbs.
  - <sup>iv</sup> Phantom Shiner (*Notropis orca*) is thought to have gone extinct in 1964.
  - <sup>v</sup> Bluntnose shiner (*Notropis simus simus*) is thought to have gone extinct in 1964.
  - <sup>vi</sup> Headwater catfish (*Ictalurus lupus*) is native to the Rio Grande and Pecos basins of Texas and New Mexico, and was once found in the headwaters of the Colorado, Guadalupe, San Antonio, and Nueces basins.
  - <sup>vii</sup> Chihuahua catfish (*Ictalurus* sp.). This undescribed catfish is restricted to the Rio Grande basin from New Mexico downstream into Texas and in the streams of the Rio Conchos as far as the Rio San Fernando. Texas records have come from the Rio Grande and Big Aguja Creek in the Davis Mountains.
  - <sup>viii</sup> Conchos pupfish (*Cyprinodon eximius*) was once found in both Terlingua and Tornillo creeks.